

# PORTUGAL

By Harold R. Newman

Portugal, which shares the Iberian peninsula with Spain, is one of the most mineralized areas of Western Europe and is geologically very complex. The mineral industry of Portugal is modest by world standards; however, its growth rate during the past few years has made minerals one of the country's dynamic industrial sectors. This was mainly because of the discovery and development of the rich copper and tin deposits of Sociedade Mineira de Neves-Corvo S.A. (Somincor) at Neves-Corvo. The country has had a long history of development of metallic minerals and was the largest producer of mined copper in the European Union in 1997.

The Government continued with the country's privatization program and was proceeding with legislation that would privatize many public companies. The privatization issue was part of a broader program to reduce the role of the state and to restructure the Portuguese economy to one that is more market driven.

The Neves-Corvo Mine of Somincor and the Panasqueira tungsten mine of Beralt Tin and Wolfram (Portugal) Ltd. were the two major operations in the metal mining sector. Pirites Alentejanas S.A.R.L. was the country's largest producer of pyrite; Siderúrgia Nacional S.A.R.L. produced iron and steel. Cimentos de Portugal, S.A. (CIMPOR), an important producer of cement, was one of the companies included in the Government's privatization plans. With the exception of copper, ferroalloys, dimension stone, tin, and tungsten, which were of international importance, production of other minerals and related materials had only domestic significance. (*See table 1.*)

Most of the large mineral-resource companies were owned or controlled by the Government, although there were some privately owned operations. (*See table 2.*) About 32,000 people were employed by the mineral industry, including mining and processing.

Somincor was 51% Government-owned through the mining conglomerate Empresa de Desenvolvimento Mineiro (EDM). The minority partner was Rio Tinto Ltd. (formerly RTZ Corp.), a U.K. company that owned 49% of the joint venture. The mine was designed to produce 1.3 million metric tons per year of raw ore to yield 500,000 metric tons per year (t/yr) of concentrate averaging 26% copper content. The estimated life of the mine, based on estimated proven reserves, was 20 years. (Richards, and others, 1991).

The Neves-Corvo complex consisted of four proven ore bodies: Graca, averaging 10% copper; Corvo, ranging from 7% to 10% copper; Neves, averaging 1% copper; and Zambujal, a complex sulfide ore of copper, lead, and zinc. Zinc and tin also occurs in the other deposits. Recovery of tin-in-concentrate has stabilized at Neves-Corvo at around 5,000 t/yr. As Neves-Corvo is primarily a copper mining operation, Somincor considers tin to be a byproduct.

Gold exploration activities were continuing in the Jales-Tres Minas gold district by the joint venture of Sociedade des Mines du Bourneix (SMB), a wholly owned subsidiary of Compagnie Générale

des Matières Nucléaires of France, and EDM. The area includes the ancient Jales Mine and is located 150 kilometers (km) east of Oporto. SMB was a 70% majority partner in the project. Jales-Tres Minas was probably the most important gold district in Portugal.

Hydrothermal auriferous quartz veins were found along faults cutting the middle to late Paleozoic peraluminous granites and Paleozoic graphite schist, mica schists, quartzites, and greywacke. The subvertical veins strike north northeast to northeast and west southwest, may reach 2.5 km long and range in width from a few centimeters to a meter. Gold and electrum (naturally occurring gold-silver alloy) were found within the quartz and the sulfides, mainly arsenopyrite, pyrrhotite, sphalerite, chalcopyrite, and galena. In the core of the vein, the average gold grade was 37 grams of gold per ton (g/t) of ore but was reduced to 11 g/t over a 1-meter (m) width. Five paragenetic stages with distinct alteration features were identified. The Jales Mine was in production early in this century and by the close of its operation, the mine had produced more than 25 metric tons (t) of gold and more than 100 t of silver and reached a depth of 630 m. (Neiva and others, 1989).

Auspex Minerals Ltd. announced results of exploration programs underway in Portugal. The Montemor gold concession was the most advanced of the company's four properties. A substantial amount of exploration was conducted by Rio Tinto Ltd. from 1984 to 1992. Drilling was continuing on the prospect. Auspex reported that there were indicated geologic reserves of 1,135,000 t grading 2.15 g/t gold. The object of the current program was to expand upon the reserve base and to progress to a feasibility study as quickly as possible (Auspex Minerals Ltd., July 1997, Portugal Update, accessed August 29, 1997, at URL <http://www.auspex-min.com/press/pr960716.htm>).

The Portuguese iron and steel operation was nationalized in 1975 to function as a public entity incorporated as Siderúrgia Nacional Empresa de Productos Planos (SN-Planos). The Government changed SN-Planos into a public, limited company as a major step toward privatization.

Beralt Tin and Wolfram (Portugal) Ltd. was the only producer of tungsten in 1997. Beralt was proceeding with development work at the Panasqueira Mine at Barroca Grande to improve efficiency and to increase the life of the mine. Most of the work was directed toward the final treatment of concentrates and toward preparations for the mining of new areas of Level 3. The treatment plant for concentrates was moved to the main zone of operation and modernized to increase capacity and to improve efficiency. Beralt also had a small production of byproduct copper and tin concentrates. The company expected that completion of capital projects underway at its operations in Peru, Portugal, and the United States would take it into the next century as one of the largest and lowest cost producers of tungsten concentrates in the world (Avocet Mining Plc., 1997, Tungsten-Beralt Tin and Wolfram (Portugal) S.A., accessed April

28, 1998, at URL [http:// www. avocet.co.uk/annual report-review of operations.htm](http://www.avocet.co.uk/annual-report-review-of-operations.htm)). Portugal's industrial minerals sector was a modern and efficient producer of a variety of materials, most notably ceramics and dimension stone. The dimension stone industry continued to be an important segment of the mining industry in terms of value and trade.

Marble was the most valuable of the stone products and accounted for the majority of stone production. The main area for marble mining continued to be the District of Evora. There was potential for increased production of granite, marble, and slate.

Demand for cement continued as the building and construction industry maintained its level of activity. This situation was expected to continue with preparations for EXPO 98 in Lisbon and the substantial volume of work in coming years to develop Portugal's infrastructure.

Coal accounted for about 4% of total energy consumption. Most coal was imported although there were some domestic reserves. Empresa Carbonifera de Douro S.A.R.L.'s Germunde Mine at Castello de Pavia closed because of high production costs and difficult mining conditions. Coal demand was growing because the electricity sector was switching from oil to coal. The two major cement producers, CIMPOR and Companhia Geral de Cale Cimento S.A. (Secil), also used coal as a major fuel source. Portugal had no natural gas reserves and no nuclear powerplants. Hydropower accounted for about 45% of electricity generation. The Government sought to diversify its energy sources and increase electrical power capacity to meet consumption growth.

The transportation network included 3,613 km of railroads, most of which was operated by the state-owned Portuguese Railroad Co. (CPR). Most of the trackage was single-track, 1.665-m gauge, of which about 15% was electrified. CPR was planning to match the European gauge width of 1.433-m, on a number of key routes throughout the country. It was expected that this would be done by adding a track to the existing lines.

The Government was planning to invest about \$22.4 billion in infrastructure improvements during the next few years. The main thrust would be the modernization of the country's ports. Major seaports were Lisbon, Porto, and Sines. These three ports were considered very important in a country where the main movement of

goods was by sea. Other areas to be improved included the highways and bridges of the national motorway network. Portugal had about 74,000 km of usable roadways, of which 84% was paved.

The present structure of the mineral industry could change in the near future because of significant mining exploration by several foreign companies. Copper, gold, kaolin, lead, lithium, pyrites, and tin were some of the minerals targeted for exploration. The Iberian Pyrite Belt (IPB), approximately 60 km wide by 250 km long, extends from the southwestern coast of Portugal near Setubal to the Guadalquivir River near Seville, Spain. This is the prime area for exploration activity.

The IPB could possibly be the oldest known major massive sulfide district to be mined. Archeological evidence shows that pyrite gossans in the area, particularly Sao Joao and Algaes at Aljustrel, were exploited by Phoenicians and/or Romans for gold and base metals. Exploration in the IPB would appear to have an above-average potential for success on the basis of district's record of about 90 documented mineralized deposits, an unusually high number of large sulfide deposits (Auspex Minerals Ltd.1997, Production and exploration opportunity in Portugal, accessed June 1, 1998, at URL <http://www.auspex-min.com/projects1.html>).

## References Cited

- Neiva, A.M., Neiva, J.M., and Silva, M.M., 1989, Geochemistry of gold quartz vein walls from Jales (Northern Portugal), International Geological Congress, 28th, Washington, DC, 1989, Abstracts 2, p. 504.
- Richards, D., Carvalho, P., and Sides, E., 1991, Geology and reserves of complex sulphides at Neves-Corvo, Symposium: Sevilla, Los Sulfuros Complejos del Suroeste de España, p. 12.

## Major Sources of Information

Cabinete Para Pesquisa e Exploração de Petróleo-MIE  
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TABLE 1  
PORTUGAL: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity	1993	1994	1995	1996	1997 e/
<b>METALS</b>					
Arsenic, white e/	150	125	125	100	100
Beryl concentrate, gross weight e/	4	4	4	4	5
Copper, mine output:					
Cu content	153,797	133,629	134,181	107,773 2/	106,500
Metal, smelter, secondary e/	1,000	--	--	--	--
Iron and steel:					
Iron ore and concentrate:					
Gross weight, manganiferous	16,175	14,330	14,535	18,620	18,000
Fe content, manganiferous	6,114	5,409	5,417	7,876	6,800
Metal:					
Pig iron thousand tons	398	415	411	421	431 2/
Crude steel do.	775	749	829	871 r/	860
Lead, refined, secondary e/	8,300	13,000	7,700 r/	5,900 r/	6,000
Manganese, Mn content of iron ore e/	500	500	500	500	500
Silver, mine output, Ag content kilograms	36,200	31,800	38,600	34,000	34,000
Tin:					
Mine output, Sn content	5,334	4,332	4,627	4,637	4,000
Metal, primary and secondary e/	100	100	100	100	100
Titanium, concentrates: e/					
Gross weight	20	20	--	--	--
Content of TiO2	5	5	--	--	--
Tungsten, mine output, W content	768	73 r/	1,103 r/	776 r/	800
Uranium concentrate, U3O8	33	28	22	17	18
Zinc, smelter, primary e/	3,500	4,200	4,000	3,600 r/	3,600
<b>INDUSTRIAL MINERALS</b>					
Barite e/	--	50	--	--	--
Cement, hydraulic thousand tons	7,600	7,500	7,500	7,200	7,400
Clays:					
Kaolin 3/	178,285	181,933	180,000 e/	177,423	180,000
Refractory e/	300,000	431,967 2/	300,000	392,148	300,000
Diatomite e/	1,860	2,150	1,780	1,550	2,000
Feldspar	90,547	92,440	106,559	98,596	100,000
Gypsum and anhydrite	458,112	450,000 e/	450,000	520,722	450,000
Lime, hydrated and quicklime e/	200,000	200,000	200,000	200,000	200,000
Lithium minerals, lepidolite	13,289	11,352	8,740	7,626	11,000
Nitrogen, N content of ammonia e/	91,000	57,900	155,100	197,600	195,600
Pyrite and pyrrhotite (including cuprous), gross weight	14,000	14,000	12,000	10,000 e/	10,000
Salt:					
Rock	524,540	519,432	544,647	609,639	600,000
Marine e/	125,000	125,000	--	--	--
Total	649,540	644,432	544,647	609,639	600,000
Sand e/	5,000	5,000	5,000	5,127	5,000
Sodium compounds, n.e.s.: e/					
Soda ash	150,000	150,000	150,000	150,000	150,000
Sulfate	50,000	50,000	50,000	50,000	50,000
Stone: e/					
Basalt thousand tons	100	530	100	100	100
Calcareous: do.					
Dolomite do.	500	471 2/	500	510	500
Limestone, marl, calcite do.	15,000	33,134 2/	15,000	35,370	15,000
Marble do.	939	935 2/	800	945	900
Diorite do.	1,000	1,029 2/	1,000	282	1,000
Gabbro do.	1,000	132 2/	100	147	100

See footnotes at end of table.

TABLE 1--Continued  
PORTUGAL: PRODUCTION OF MINERAL COMMODITIES 1/

(Metric tons unless otherwise specified)

Commodity	1993	1994	1995	1996	1997 e/
<b>INDUSTRIAL MINERALS--Continued</b>					
Stone e/--Continued:					
Granite thousand tons	8,500	17,360 2/	10,000	252	10,000
Graywacke do.	20	138 2/	20	60	20
Ophite do.	50	110	50	50	50
Quartz do.	9	14 2/	28	14	25
Quartzite do.	500	526 2/	500	594	500
Schist do.	100	273 2/	100	260	100
Slate do.	61	40	30	20	30
Syenite do.	30	58 2/	25	39	25
Sulfur: e/					
Content of pyrites	5,000	5,000	5,000	5,000	5,000
Byproduct, all sources	4,000	4,000	4,000	4,000	3,000
Total	9,000	9,000	9,000	9,000	8,000
Talc	9,054	8,367	8,400 e/	8,277	8,500
<b>MINERAL FUELS AND RELATED MATERIALS</b>					
Coal, anthracite e/ thousand tons	216 2/	148 2/	140	--	--
Coke, metallurgical e/ do.	150	150	329 r/ 2/	332 r/ 2/	330
Gas, manufactured e/ million cubic meters	125	125	125	125	125
Petroleum refinery products: e/					
Liquefied petroleum gas thousand 42-gallon barrels	4,500	4,600	4,768 r/ 2/	4,338 r/ 2/	4,500
Gasoline do.	14,000	15,000	23,826 r/ 2/	21,828 r/ 2/	15,000
Jet fuel do.	5,000	5,000	8,000 r/ e/	7,500 r/ e/	7,000
Kerosene do.	225	225	400 r/ e/	400 r/ e/	225
Distillate fuel oil do.	20,000	20,000	20,000	20,000	20,000
Residual fuel oil do.	20,000	20,000	20,000	20,000	20,000
All other products do.	8,800	9,000	9,000	9,000	10,000
Refinery fuel and losses do.	3,500	3,500	3,500	3,500	3,000
Total do.	76,025	77,325	89,494 r/	86,566 r/	77,525

e/ Estimated. r/ Revised.

1/ Table includes data available through May 1998.

2/ Reported figure.

3/ Includes washed and unwashed kaolin.

TABLE 2  
PORTUGAL: STRUCTURE OF THE MINERAL INDUSTRY IN 1997

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of facilities	Annual capacity
Cement	Cimentos de Portugal S.A. (CIMPOR) (Government, 100%)	10 plants, various locations	6,000
Coal	Empresa Carbonifera de Douro S.A.R.L. (ECD) (Government, 100%)	Germunde Mine at Castello de Pavia (closed-maintenance standby)	150
Copper concentrate	Sociedade Mineira de Neves-Corvo S.A. (Somincor) (Government, 51%; Rio Tinto Ltd., 49%)	Neves-Corvo Mine near Castro Verde	500
Diatomite	Sociedade Anglo-Portuguesa de Diatomite Lda.	Mines at Obidos and Rolica	5
Feldspar	A.J. da Fonseca Lda.	Seixigal Quarry, Chaves	10
Ferroalloys	Electrometalúrgia S.A.R.L.	Plant at Setubal	100
Petroleum, refined      barrels per day	Petroleos de Portugal (Petrogal) (Government 100%)	Refineries at Lisbon, Porto, and Sines	300,000
Pyrite	Pirites Alentejanas S.A.R.L.	Plant at Setubal	100
Steel, crude	Siderurgia Nacional S.A.R.L. (SN) (Government 100%)	Ironworks and steelworks at Seixal and Maia	1,000
Tin	Sociedade Mineira de Neves-Corvo S.A. (Somincor) (Government 51%, Rio Tinto Ltd., 49%)	Neves-Corvo Mine near Castro Verde	5
Tungsten	Beralt Tin and Wolfram (Portugal) Ltd. (Avocet Mining Plc. 100%)	Panasqueira Mine and plant at Barroca Grande	1,600
Uranium      tons	Empresa Nacional de Uranio (Government 100%)	Mines and plant at Guargia	170
Zinc, refined	Quimigal E.P. (Government 100%)	Electrolytic plant at Barreiro	11